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(54) **Apparatus for counting a number of paper sheets**

(57) An apparatus for counting a target number of paper sheets is described in which the target number entered by an entry unit (2a,2b,2c) is stored in a target number memory (12) and displayed in a target number display section (4a), the count number supplied from a sensor and counter section (3b) since the time of start of counting is displayed in a count number display section (4b) and compared to said target number, and the counting number is discontinued in case of coincidence between said count number and the target number. According to the invention, the entry section has a batch key (2a), a plus key (2b) and a minus key (2c). A gross or an approximate number (say, 10, 20, 50 or 100) is entered by the batch key (2a) and incremented or decremented by the

FIG.2.

plus key (2b) or minus key (2c) by one at a time for adjustment of the gross number to the desired target number. When the gross number is the infinite number, a continuous counting operation is performed until depletion of the paper sheets.
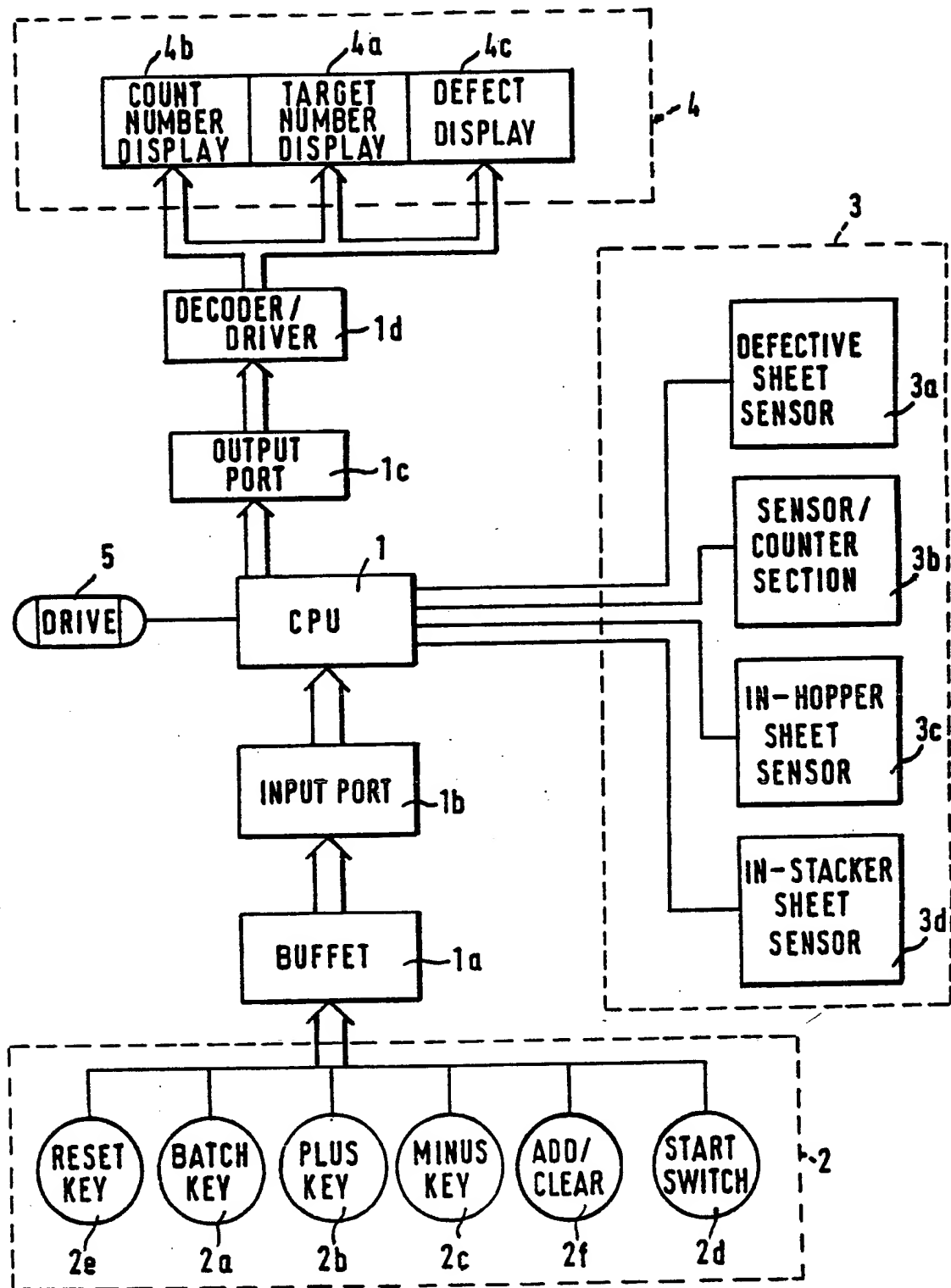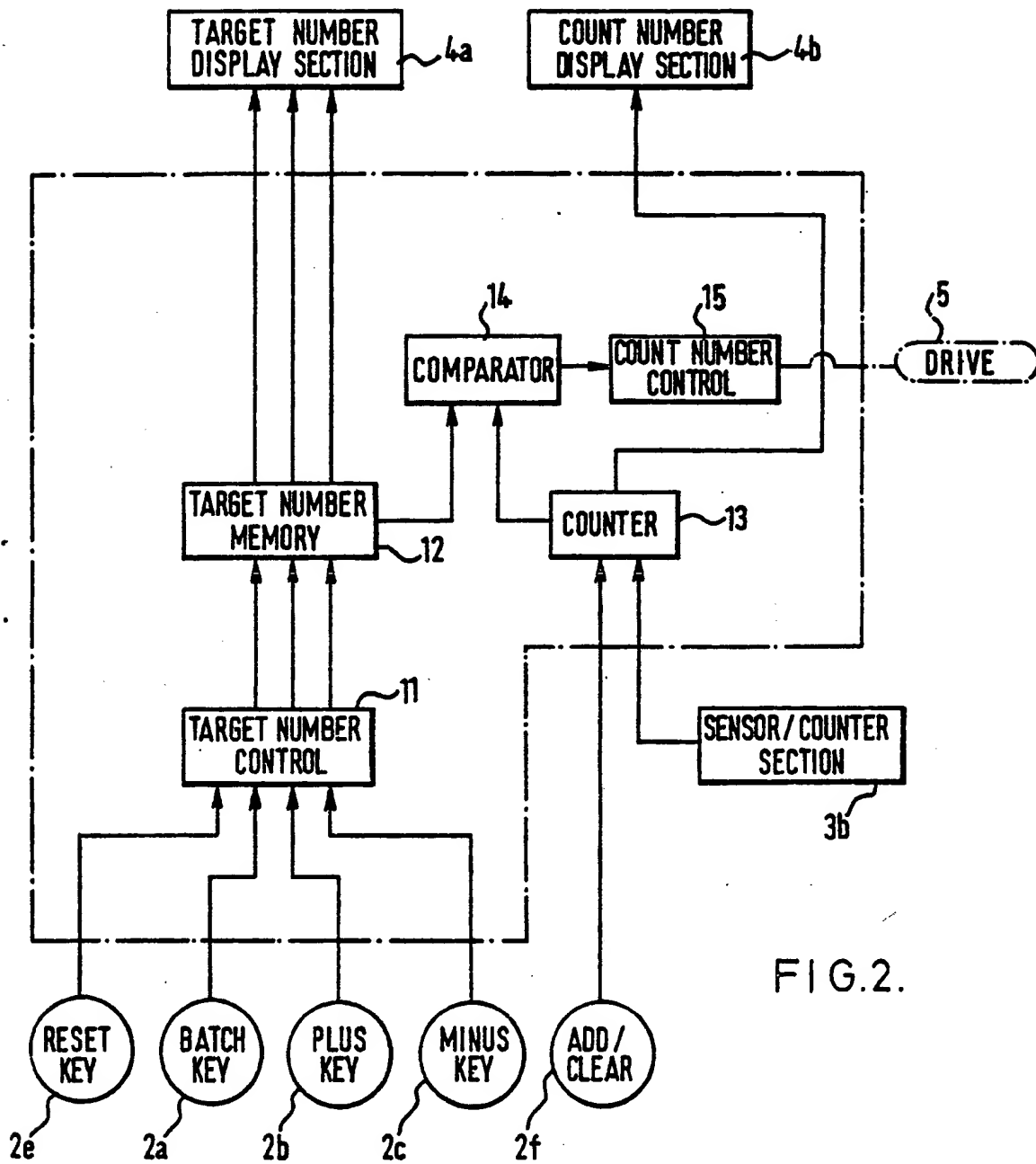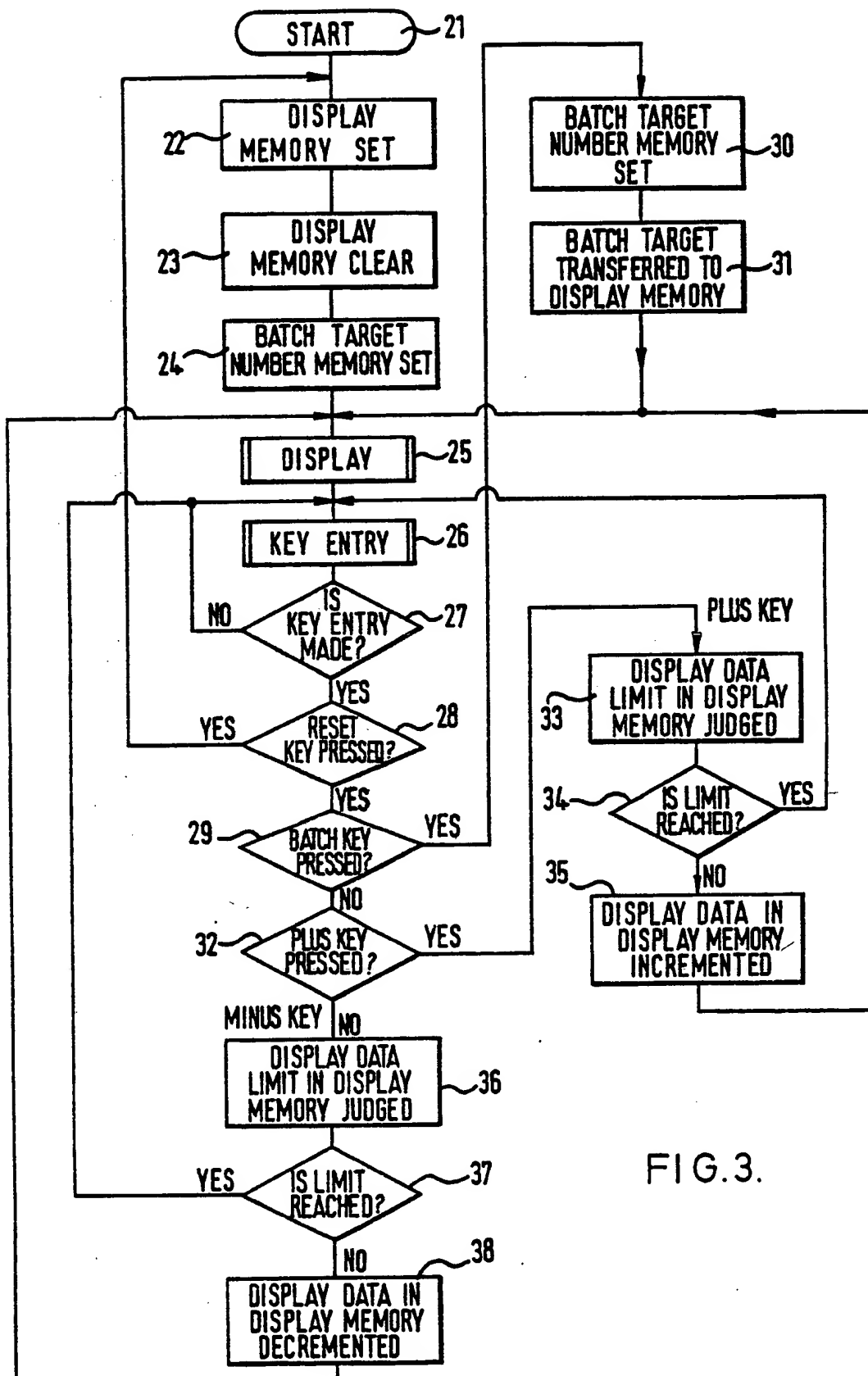
FIG.1.

FIG.2.

START ~ 21

22 — DISPLAY MEMORY SET

23 — DISPLAY MEMORY CLEAR

24 — BATCH TARGET NUMBER MEMORY SET

DISPLAY ~ 25

KEY ENTRY ~ 26

IS KEY ENTRY MADE? ~ 27 — NO

YES

RESET KEY PRESSED? ~ 28 — YES

YES

BATCH KEY PRESSED? — 29 — YES

NO

PLUS KEY PRESSED? — 32 — YES

MINUS KEY | NO

BATCH TARGET NUMBER MEMORY SET ~ 30

BATCH TARGET TRANSFERRED TO DISPLAY MEMORY ~ 31

PLUS KEY

33 — DISPLAY DATA LIMIT IN DISPLAY MEMORY JUDGED

34 — IS LIMIT REACHED? — YES

NO

35 — DISPLAY DATA IN DISPLAY MEMORY INCREMENTED

36 — DISPLAY DATA LIMIT IN DISPLAY MEMORY JUDGED

IS LIMIT REACHED? ~ 37 — YES

NO

38 — DISPLAY DATA IN DISPLAY MEMORY DECREMENTED

FIG.3.

SPECIFICATION

Apparatus for counting a number of paper sheets

5   This invention relates to an apparatus for counting a
number of paper sheets.
   Known apparatus of this type is used for counting
the number of banknotes, voting cards, checks or
bills. In general, the methods of counting the sheets
10   may be variable with the objective of counting. For
example, a method of continuous counting may be
employed when it is desired to obtain the total
number of paper sheets in subject or to ascertain
that the actual number of paper sheets is equal to the
15   indicated value. On the other hand, batch counting
may be resorted to when the paper sheet in subject
are to be arranged in bundles or batches each
containing a predetermined number of the sheets.
   An apparatus of this type is described for instance
20   in our copending Japanese Laid-Open Patent Speci-
fication No. 58-6023 entitled "Apparatus for Count-
ing the Number of Voting Cards" filed on July 3,
1981. In a method of batch counting or voting cards
disclosed in said Patent Application, the number of
25   the voting cards making up each bundle or batch and
stored in the memory of the counting apparatus is
entered by a knob to a desired one of a plurality of
predetermined values such as 10, 20, 50, 100, 200
and infinity (oo). The counting apparatus disclosed
30   in said Patent Application is so designed and
constructed that condition judgement signals or
count number signals from the associated sensors
are used to display the presence of defective cards or
defective transfer states as the above signals are
35   transferred through the memory, comparator or
control units.
   In the aforementioned counting apparatus, the
number of paper sheets once entered by the knob for
the batch operation is fixed and it is impossible to
40   enter an arbitrarily selected number other than such
fixed value. Thus the apparatus is not applicable to
counting the number of paper sheets in general. For
entering an arbitrarily selected number, it is also
known to use a ten-key board in place of the entry
45   knob and to designate the desired number by
selective actuation of the numerical keys. The num-
ber thus entered is stored in a memory and occa-
sionally compared to the actual count number and a
count terminating signal is issued when there is a
50   coincidence between the target number and the
count number. With such ten-key boards, it is
impossible to reduce the overall size of the appar-
atus because of structural requirements. In addition,
the operation of the apparatus is complicated be-
55   cause the same number of keys as that of the digits
need be actuated each time a new target is entered
in the apparatus.
   A counting apparatus is also known in which the
display in the count number display unit in the
60   magnetic counter is incremented and the display in
the number entry unit peratively geared to said
count number display unit is decremented with each
passage of a banknote, and in which the counting
peration is terminated wh n th preset number in
65   the entry unit is nil. With this apparatus, the

operation is complicated because it is necessary to
disconnect the display unit from the entry unit each
time a new target number is set and to connect the
two units after setting the new target number. Any
70   error caused in the connecting and disconnecting
process may lead to destruction of the counter units.
In addition, with this counting apparatus, it is
impossible to reduce the overall size of the appar-
atus or to elevate the rate of counting because of
75   structural constraints.
   According to the present invention there is pro-
vided an apparatus for counting a number o paper
sheets comprising means to store a target number,
entered by an entry unit, in a target number memory
80   for display in a target number display section, means
to display a paper sheet count number supplied from
a sensor and counter section since a time of start of a
counting operation in a count number display sec-
tion and to compare it to said target number, and
85   means to discontinue the counting operation in case
of coincidence between said count number and the
target number, said entry section having a batch key,
a plus key and a minus key, said target number
memory having stored therein, in use, a predeter-
90   mined number of fixed data that are displayed
cyclically during the time said batch key is operated,
means to discontinue the cyclic display upon termi-
nation of the batch key operation, means to enter
one of said fixed data prevailing at the time of
95   termination of the batch key operation in said target
number memory, means to increment or decrement
the fixed data thus entered in said target number
memory by one each time said plus or minus key
respectively is operated, the incremented or de-
100   cremented data prevailing when the plus or minus
key is entered as said target number, and means to
compare the target number thus entered to the
count number from said sensor and counter section.
   A microprocessor may be used as an arithmetic
105   operation unit for reducing the overall size of the
apparatus.
   The invention will be described by way of example
with reference to the accompanying drawings,
wherein;-
110   *Figure 1* is a block diagram schematically showing
an apparatus embodying the present invention;
   Figure 2 is a block diagram showing the inside of a
central processing unit; and
   Figure 3 is a flowchart for illustrating the operation
115   of the unit shown in Figure 2.
   In Figure 1, there is illustrated schematically an
operating circuit of a paper sheet counting apparatus
embodying the present invention. Various signals
from an operating part 2 and a sensor part 3 are
120   inputted through a buffer 1a and an input port 1b to a
central processing unit or CPU 1, where these
signals underg comparison or an arithm tic opera-
tion for controlling the operation of a driving part 5
which is designed to feed out the paper sheets for
125   counting. Simultaneously, those signals are applied
t a display part 4 for display through an output port
1c and a decoder/driver circuit 1d.
   The target number of she ts entered by keys 2a,
2b and 2c is transferred through CPU and displayed
130   n a target number display part 4a. Then, upon

actuation of a start switch 2d, the paper sheets
placed in a hopper, not shown, are fed out one by
one by the driving unit 5 to be stacked on a stacker,
also not shown. Each paper sheet thus fed out is
5 sensed by a sensor/counter 3b of the sensor unit 3,
and the resulting sensor/counter signals are sup-
plied to CPU 1, while the corresponding count
number is displayed in a count number display part
4b. When the target number in the display part 4a is
10 coincidence with the count number in the display
part 4b, the CPU 1 detects this state to deactivate the
driving unit 5.
    A defective sheet sensor part 3a operates to check
the state of paper being transferred to find out those
15 defective sheets which may lead to counting errors.
For example, when two or more superposed or
consecutive sheets or halved sheets are detected,
this state is displayed on a defect display part 4c
while the operation of the driving unit 5 is halted.
20   The operating circuit in the CPU 1 of the counting
apparatus shown schematically in Figure 2 in greater
detail. Since the defective sheet sensor part 3a and
the defective sheet display part may be similar to
those shown in the said Japanes Laid-Open Patent
25 Specification No. 58-6023, they are not shown in
Figure 2. In this Figure, signals from a batch key 2a, a
plus key 2b and a minus key 2c are supplied to a
target number control unit 11 which then operates
an output data stored in a target number memory 12
30 to a target number display 4a for display. Simul-
taneously, these data are supplied to a comparator
14. The count number signal from the sensor/
counter 3b is supplied to a counter 13. The count
number signal from the counter 13 is outputted to
35 the count number display part 4b for display and to
the comparator 14. Signals from an add/clear
changeover switch 2f are also supplied to the
counter 13 which then operates to sum the count
numbers for respective batch operations when the
40 switch 2f is levelled to add and to clear the count
number display upon termination of the respective
batch operations when the switch 2f is levelled to
clear.
    The comparator 14 compares the target number
45 signal from the target number memory 12 to the
count number from the counter 13, and outputs a
coincidence signal to a count number control unit 15
when the two signals coincide with one another. The
control part 15 outputs a stop signal to the driving
50 unit 5.
    The operation of CPU for display of the number of
paper sheets shown in Figure 2 is described below
by referring to a flow chart shown in Figure 3. The
operation is started upon connection to a power
55 source (block 21). When the operation is started, a
display memory in the target number memory 12 is
reset to zero while it is activated for data storage
(blocks 22, 23). A batch target number memory in the
memory 12 is also activated for data storage (block
60 24). Fixed data for target numbers such as 100, 50,
20, 10 and infinity (oo) are stored in this batch target
numb r mem ry. In initial state, zero is displayed in
the target number display unit 4a (block 25). Next, a
selected on of batch key 2a, plus key 2b, minus key
65 2c or reset key 2c i pressed (blocks 26 and 27).

When the reset key 28 is pressed, the display in the
display unit 4a is cleared ("yes" in block 28). Wh n
the batch key 2a is pressed (block 29), the fixed data
100, 50, 20, 10 and infinity (oo) stored in the batch
70 target number memory are transferred sequentially
into the aforementioned display memory, and are
displayed cyclically in the display part 4a (blocks 30,
31). When the manual pressure on the display
memory 12 is released, the current one of the fixed
75 data is stored in the display memory and displayed
in the display part 4a.
    When the plus key 2b is pressed subsequently, the
number as set by the batch key 2a is incremented by
one. When the manual pressure on the plus key is
80 released the incremented number is displayed
(blocks 32, 33, 34, 35). When the minus key 2c is
pressed, the displayed target number is de-
cremented by one. When the manual pressure on
the key is released, the decremented number is
85 displayed ("no" in block 32). A certain limitation (for
example, 100) is provided to the increment or
decrement operations to be performed with the plus
or minus keys and these operations are discontinued
in the event that the key operations should cause this
90 limit to be exceeded (blocks 34, 37).
    In this manner, the desired target number of paper
sheets is stored in the target number memory 12.
This number is also supplied to the comparator 14 as
mentioned hereinabove.
95   In the case of a continuous counting operation, an
infinity mark oo is displayed by batch key 2a in the
display part 4a. By this, the comparator 14 is
disabled to check for coincidence between the signal
from the counter 13 and the signal from the target
100 memory 12 so that the counting operation is con-
tinued until depletion of the paper sheets stored in
the hopper for counting. The batch counting opera-
tion can be performed with the desired target
number of the paper sheets displayed in the display
105 part 4a by using the batch key and the plus or minus
key.
    In the above embodiment, start switch 2d is
pressed for starting the counting. However, this start
switch may be replaced by a manual/auto changeov-
110 er switch so that the switch acts in the same manner
as start switch 2d when set to manual, and the
automatic counting operation may be started when
the switch is set to auto. In the latter case, the
automatic counting may be initiated by taking the
115 AND of a signal from an in-hopper sheet sensor 3c
indicating the presence of the paper sheets in the
hopper, a signal from an in-stacker sheet sensor 3d
indicating the absence of the paper sheets in the
stacker and a signal indicating termination of target
120 number entry and display operations.
    The various operations described in the foregoing
may be taken charge of by a microprocessor to
provide a pap r sh et counting apparatus which is
extr m ly small in size and hence can be handled
125 c nveniently.

CLAIMS

    1.   An apparatus for counting a number of paper
130 sheets comprising means t store a target number,

entered by an entry unit, in a target number memory
for display in a target number display section, means
to display a paper sheet count number supplied from
a sensor and counter section since a time of start of a
5 counting operation in a count number display sec-
tion and to compare it to said target number, and
means to discontinue the counting operation in case
of coincidence between said count number and the
target number, said entry section having a batch key,
10 a plus key and a minus key, said target number
memory having stored therein, in use, a predeter-
mined number of fixed data that are displayed
cyiically during the time said batch key is operated,
means to discontinue the cyclical display upon
15 termination of the batch key operation, means to
enter one of said fixed data prevailing at the time of
termination of the batch key operation in said target
number memory, means to increment or decrement
the fixed data thus entered in said target memory by
20 one each time said plus or minus key respectively is
operated, the incremented or decremented data
prevailing when the plus or minus key is entered as
said target number, and means to compare the
target number thus entered to the count number
25 from said sensor and counter section.

2.   An apparatus as claimed in claim 1, wherein
said fixed data include an infinite number (oo) and
wherein a continuous counting operation is per-
formed when the infinite number is entered in said
30 target number memory as said fixed data.